

**WHAT IS CLAIMED IS:**

- 1 1. A method for determining the presence or concentration  
2 of a substance in a medium, the method comprising:
  - 3 a) providing a sensor in the medium, wherein the  
4 sensor includes at least one optical carrier and a  
5 microsphere having a surface including receptors for  
6 the substance, each of the at least one optical  
7 carrier being coupled with the microsphere;
  - 8 b) applying a light source to one of the at least one  
9 optical carriers of the sensor;
  - 10 c) detecting a transmission spectra of light from one  
11 of the at least one optical carriers of the sensor;  
12 and
  - 13 d) determining a presence or concentration of the  
14 substance based on a change in the transmission  
15 spectra the detected light.
- 1 2. The method of claim 1 further comprising:
  - 2 - determining a change in the transmission spectra of  
3 the light due to a factor other than adsorption of the  
4 substance onto the surface of the microsphere,  
5 wherein the act of determining a presence or  
6 concentration of the substance based on a property of the  
7 detected light, wherein the property is based on a change  
8 in the transmission spectra of the light, compensates for  
9 the determined change in the transmission spectra of the  
10 light due to a factor other than adsorption of the  
11 substance onto the surface of the microsphere.
- 1 3. The method of claim 2 wherein the sensor includes a  
2 second microsphere coupled with each of the at least one

3 optical carrier,  
4 wherein the second microsphere has a surface that is  
5 free of receptors for the substance, and  
6 wherein the act of determining a change in the  
7 transmission spectra of the light due to a factor other  
8 than adsorption of the substance on the surface of the  
9 microsphere is based on a change in the transmission  
10 spectra of the light due to the second microsphere.

1 4. A system for determining the presence or concentration  
2 of a substance in a medium, the system comprising:  
3 a) a sensor, for immersion in the medium, the sensor  
4 including  
5 i) at least one optical carrier, and  
6 ii) a microsphere having a surface including  
7 receptors for the substance, each of the at least  
8 one optical carrier being coupled with the  
9 microsphere;  
10 b) a light source for applying light to one of the at  
11 least one optical carriers of the sensor;  
12 c) a detector for detecting light from one of the at  
13 least one optical carriers of the sensor; and  
14 d) means for determining a presence or concentration  
15 of the substance using a shift in the transmission  
16 spectra of the detected light.

1 5. The system of claim 4 wherein the sensor further  
2 includes  
3 iii) a second microsphere coupled with each of  
4 the at least one optical carrier, wherein the  
5 second microsphere has a surface that is free of

6 receptors for the substance.

1 6. For use in a system including a light source, and a  
2 light detector, for determining the presence or  
3 concentration of an explosive substance in a medium, a  
4 sensor comprising:

5 a) at least one optical fiber;

6 b) at least one microsphere, the at least one  
7 microsphere

8 i) being coupled with the optical fiber, and

9 ii) having a surface including receptors for the  
10 substance, wherein the receptors include  
11 polyaromatic compounds.

1 7. The sensor of claim 6 wherein the polyaromatic  
2 compounds are pyrenes.

1 8. The sensor of claim 6 wherein the explosive substance  
2 is TNT.

1 9. For use in a system including a light source, and a  
2 light detector, for determining the presence or  
3 concentration of a poison gas in a medium, a sensor  
4 comprising:

5 a) at least one optical fiber;

6 b) at least one microsphere, the at least one  
7 microsphere

8 i) being coupled with the optical fiber,

9 ii) having a surface including receptors for the  
10 substance, wherein the receptors include  $\text{EU}^{3+}$   
11 chelate.

1 10. The sensor of claim 6 wherein the poison gas is Soman.

1 11. A method for fabricating a sensor for determining the  
2 presence or concentration of an explosive substance in a  
3 medium, the method comprising:

- 4 a) bridging at least one microsphere and an at least  
5 one optical core; and  
6 b) functionalizing a surface of the microsphere with  
7 polyaromatic compound receptors.

1 12. The method of claim 11, wherein the polyaromatic  
2 compound receptors include pyrenes.

1 13. The method of claim 12, wherein the act of  
2 functionalizing the microsphere surface with pyrene  
3 receptors includes:

- 4 i) reacting pyrene butanol with dichlorodimethylsilane  
5 to generate a product, and  
6 ii) reacting the product with a silanol on the  
7 surface of the microsphere.

1 14. The method of claim 13 wherein the explosive substance  
2 is TNT.

1 15. A method for fabricating a sensor for determining the  
2 presence or concentration of a poison gas in a medium, the  
3 method comprising:

- 4 a) bridging at least one microsphere and an at least  
5 one optical core; and  
6 b) functionalizing a surface of the microsphere with  
7  $\text{EU}^{3+}$  chelate receptors.

1 16. The method of claim 15, wherein the act of  
2 functionalizing the microsphere surface with  $\text{EU}^{3+}$  chelate  
3 receptors includes reacting diketone with an amine on the  
4 surface of the microsphere.

1 17. The method of claim 15 wherein the poison gas is  
2 Soman.